

CLAIMS

Having thus described the invention, what is claimed as new and desirable to be secured by Letters Patent is as follows:

- 1 1. A spin valve device comprising:
 - 2 a free layer (FL)
 - 3 a spacer layer (CU),
 - 4 a pinned layer (PIL),
 - 5 an antiferromagnetic layer (AFM2), and
 - 6 a patterned underlayer that includes a magnetic material (TFM, PM) for
 - 7 providing trackwidth and longitudinal bias.
- 8 2. A spin valve device in accordance with claim 1 wherein said magnetic
9 material in said underlayer includes an antiferromagnetic material selected
10 from the group consisting of IrMn, RhMn, RuMn, RuRhMn, FeMn, FeMnRh,
11 FeMnCr, CrPtMn, TbCo, NiMn, PtMn, PtPdMn, NiO, CoO, and CoNiO.
- 12 3. A spin valve device in accordance with claim 1 wherein:
 - 13 said patterned underlayer comprises:
 - 14 a buffer layer,
 - 15 an antiferromagnetic layer, and
 - 16 a ferromagnetic layer.
- 17 4. A spin valve device in accordance with claim 3 wherein:
 - 18 said buffer layer consists of a material selected from the group
 - 19 consisting of Nb, Ta, Ti, Zr, Hf, Mo, W.

- 1 5. A spin valve device in accordance with claim 3 wherein:
2 said ferromagnetic layer consists of at least one material selected from
3 the group consisting of Co, CoFe, Ni, and NiFe.
- 4 6. A spin valve device in accordance with claim 3 wherein:
5 a conductor is provided consisting of a material selected from the group
6 consisting of Au, Ag, W, Mo, Rh, Ru, Ti, β -Ta, TiW, TaW, and $\text{Cu}_{50}\text{Au}_{50}$.
- 7 7. A spin valve device in accordance with claim 1 wherein:
8 said magnetic material in said underlayer comprises an antiferromagnet,
9 and
10 a conductor layer with reduced lead resistance was added and aligned
11 after spin valve deposition.
- 12 8. A spin valve device in accordance with claim 1 wherein:
13 said magnetic material in said underlayer comprises an antiferromagnet,
14 and
15 a conductor layer edge is wider than an edge of an underlayer.
- 16 9. A spin valve device in accordance with claim 1 wherein:
17 said magnetic material in said underlayer comprises an antiferromagnet,
18 and
19 a conductor layer edge is smaller than an edge of an underlayer edge.
- 20 10. A spin valve device in accordance with claim 1 wherein said magnetic
21 material in said underlayer comprises a hard biasing, permanent magnet for
22 providing trackwidth and longitudinal bias.

- 1 11. A spin valve device in accordance with claim 10 wherein said hard biasing,
2 permanent magnet is longitudinally magnetized.
- 3 12. A spin valve device in accordance with claim 11 wherein said hard biasing,
4 permanent magnet consists of a material selected from the group consisting
5 of Co, CoPt, CoSm, CoPtCr, CoCrTa, CoPtB, CoCrTaPt, and CoCrPtB.
- 6 13. A spin valve device in accordance with claim 10 wherein said hard biasing,
7 permanent magnet is vertically magnetized.
- 8 14. A spin valve device in accordance with claim 13 wherein said hard biasing,
9 permanent magnet consists of a material selected from the group consisting
10 of Co, CoCr, CoSm, Ba-ferrite.
- 11 15. A spin valve device in accordance with claim 10 wherein said patterned
12 underlayer consists of a conductor layer and a hard biasing, permanent
13 magnet.
- 14 16. A spin valve device in accordance with claim 10 wherein said patterned
15 underlayer consists of conductor layer, a buffer layer and a hard biasing,
16 permanent magnet.
- 17 17. A spin valve device in accordance with claim 16 wherein said conductor
18 consists of a material selected from the group consisting of Au, Ag, W, Mo,
19 Rh, Ru, Ti, β -Ta, TiW, TaW, $\text{Cu}_{50}\text{Au}_{50}$.

1 18. A spin valve device in accordance with claim 16 wherein said buffer layer
2 consists of a material selected from the group consisting of Cr, V, Ta,
3 and W.

4 19. A spin valve device in accordance with claim 10 wherein:

5 said patterned underlayer consists of conductor layer, a buffer layer
6 and a hard biasing, permanent magnet, and

7 said conductor consists of a material selected from the group consisting
8 of Au, Ag, W, Mo, Rh, Ru, Ti, β -Ta, TiW, TaW, $\text{Cu}_{50}\text{Au}_{50}$.

9 20. A spin valve device in accordance with claim 10 wherein:

10 said patterned underlayer consists of conductor layer, a buffer layer
11 and a hard biasing, permanent magnet,

12 said conductor consists of a material selected from the group consisting
13 of Au, Ag, W, Mo, Rh, Ru, Ti, β -Ta, TiW, TaW, $\text{Cu}_{50}\text{Au}_{50}$, and

14 said buffer layer consists of a material selected from the group
15 consisting of Cr, V, Ta, and W.

1 21. A method of forming a spin valve device comprising:

2 forming a patterned underlayer including a magnetic material for

3 providing trackwidth and longitudinal bias,

4 forming a free layer,

5 forming a pinned layer,

6 forming a spacer layer, and

7 forming an antiferromagnetic layer.

8 22. A method in accordance with claim 21 wherein:

9 said magnetic material in said underlayer comprises a material selected
10 from an antiferromagnet underlayer and a permanent magnetic underlayer,
11 and

12 trackwidth definition is accomplished by dry etching and stopping at a
13 buffer layer.

14 23. A method in accordance with claim 21 wherein:

15 said magnetic material in said underlayer comprises an antiferromagnet
16 underlayer, and

17 trackwidth definition is accomplished by liftoff through photoresist
18 stencil.

19 24. A method in accordance with claim 21 wherein reduced lead resistance is
20 achieved by adding and aligning a conductor layer after spin valve
21 deposition.

22 25. A method in accordance with claim 21 including providing a conductor layer
23 edge which is wider than an underlayer edge.

- 1 26. A method in accordance with claim 21 including providing a conductor layer
2 edge which is smaller than an underlayer edge.
- 3 27. A method in accordance with claim 21 wherein trackwidth definition is
4 accomplished by dry etching and stopping at buffer layer.
- 5 28. A method in accordance with claim 21 wherein trackwidth definition is
6 accomplished by liftoff through photoresist stencil.
- 7 29. A method in accordance with claim 21 wherein reduced lead resistance is
8 achieved by adding an aligning conductor layer after spin valve deposition.
- 9 30. A method in accordance with claim 29 wherein said aligning conductor layer
10 is one of Au, Ag, W, Mo, Rh, Ru, Ti, β -Ta, TiW, TaW, and $\text{Cu}_{50}\text{Au}_{50}$.
- 11 31. A method in accordance with claim 21 including a conductor having a layer
12 edge wider than an underlayer edge.
- 13 32. A method in accordance with claim 21 including a conductor having a layer
14 edge smaller than an underlayer edge.

1 33. A method of forming a spin valve device comprising:

2 forming a patterned underlayer including a permanent magnetic material
3 for providing trackwidth, longitudinal bias, and exchange stabilization,
4 forming a free layer,
5 forming a pinned layer,
6 forming a spacer layer, and
7 forming an antiferromagnetic layer.

8 34. A method in accordance with claim 33 wherein:

9 said permanent magnetic material in said patterned underlayer is
10 selected from the group consisting of Co, CoPt, CoSm, CoPtCr, CoCrTa,
11 CoPtB, CoCrTaPt, and CoCrPtB, and
12 trackwidth definition is accomplished by dry etching and stopping at a
13 buffer layer.

14 35. A method in accordance with claim 33 wherein:

15 said permanent magnetic material in said patterned underlayer is
16 selected from the group consisting of Co, CoPt, CoSm, CoPtCr, CoCrTa,
17 CoPtB, CoCrTaPt, and CoCrPtB, and
18 trackwidth definition is accomplished by liftoff through photoresist
19 stencil.

20 36. A method in accordance with claim 33 wherein reduced lead resistance is
21 achieved by adding and aligning a conductor layer after spin valve
22 deposition.

- 1 37. A method in accordance with claim 33 wherein a conductor layer edge is
2 wider than an underlayer edge.
- 3 38. A method in accordance with claim 33 wherein a conductor layer edge is
4 smaller than an underlayer edge.
- 5 39. A method in accordance with claim 33 wherein trackwidth definition is
6 accomplished by dry etching and stopping at buffer layer.
- 7 40. A method in accordance with claim 33 wherein trackwidth definition is
8 accomplished by liftoff through photoresist stencil.
- 9 41. A method in accordance with claim 33 wherein reduced lead resistance is
10 achieved by adding an aligning conductor layer after spin valve deposition.
- 11 42. A method in accordance with claim 41 wherein said aligning conductor layer
12 is one of Au, Ag, W, Mo, Rh, Ru, Ti, β -Ta, TiW, TaW, and $\text{Cu}_{50}\text{Au}_{50}$.
- 13 43. A method in accordance with claim 33 including a conductor having a layer
14 edge which is wider than an underlayer edge.
- 15 44. A method in accordance with claim 33 including a conductor layer having an
16 edge which is smaller than an underlayer edge.